

## **A3I Visibility Modeling Project**

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The Army-NASA Aircrew Aircraft Integration program is supporting a joint project to build a visibility computer-aided design (CAD) tool. The principal participants in the project are Dr. James Larimer of the Ames Research Center, Dr. Aries Arditi of the Research Department of the New York Association for the Blind, Dr. James Bergen of the SRI Sarnoff Research Laboratories, and Dr. Norman Badler of the University of Pennsylvania.

CAD has become an essential tool in modern engineering applications. CAD tools are used to create engineering drawings and to evaluate potential designs before they are physically realized. The visibility CAD tool will provide the design engineer with a tool to aid in the location and specification of windows, displays, and control in crewstations. In an aircraft cockpit the location of instruments and the emissive and reflective characteristics of the surfaces must be determined to assure adequate aircrew performance. For example, how big should letters be on a display to assure that they can always be read without error? How much contrast should the symbols have with the background? How bright should emissive displays be so that they will not be "washed out" by bright sunlight?

The visibility CAD tool will allow the designer to ask and answer many of these questions in the context of a three-dimensional graphical representation of the cockpit. The graphic representation of the cockpit is a geometrically valid model of the cockpit design. A graphic model of a pilot, called the pilot manikin, can be placed naturalistically in the cockpit model. The visibility tool has the capability of mapping the cockpit surfaces and other objects modeled in this graphic design space onto the simulated pilot's retinas for a given visual fixation. Moreover, the binocular retinal "footprint" can be mapped onto the environmental surfaces implied by the cockpit design and modeled objects in the graphic space. These capabilities and the sequential application of them permit the designer to estimate the required size and contrast of letters, numbers and symbols to be used by the instruments. Moreover, the system will permit the application of human visual processing models to predict the legibility of textual materials in the displays. Models of the ambient lighting and the adaptation state of the simulated pilot are being adapted to permit predictions of visibility and legibility over a large variety of conditions.